

# NATIONAL CONFERENCE ON WATER-QUALITY FIELD ACTIVITIES

## Orlando, Florida—November 19-22, 2002

### ABSTRACTS

#### PRESENTATIONS

##### **Keynote address**

##### **Everglades Restoration**

**By: Dr. Nick Aumen, National Park Service, Loxahatchee Nat'l Wildlife Refuge, 10216 Lee Rd, Boynton Beach, FL 33437, [nick\\_aumen@nps.gov](mailto:nick_aumen@nps.gov)**

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##### **The New Florida "Footprint"**

**By: Jeffrey Keay, U.S. Geological Survey, Florida Integrated Science Center, 412 NE 16th Ave, Room 250, Gainesville, Florida 32601, [jeff\\_keay@usgs.gov](mailto:jeff_keay@usgs.gov)**

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##### **U.S. Geological Survey, Office of Water Quality – Updates**

**By: Stephen Sorenson, U.S. Geological Survey, Office of Water Quality, 412 National Center, Reston, Virginia 20192, [sorenson@usgs.gov](mailto:sorenson@usgs.gov)**

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##### **The *National Field Manual* Project: What's New, What's Changing [Going Gangbusters!!]**

**By: Francesca Wilde, U.S. Geological Survey, Office of Water Quality, 412 National Center, Reston, Virginia 20192, [fwilde@usgs.gov](mailto:fwilde@usgs.gov)**

*The National Field Manual for the Collection of Water-Quality Data (NFM)* is the official reference for the standard field methods to be used by all USGS water-quality personnel, articulating methods requirements and options as well as recommendations and general guidance. The project began in 1993 as the collaborative brainchild of the Office of Water Quality and the National Water-Quality Assessment Program, to ensure use of consistent and scientifically sound field methods in order to produce water-quality data that are nationally comparable. Since publication in 1997 of the first of nine TWRI reports that now comprise the *NFM*, its format is expanding from paper-based to Web-based platforms that are currently in use in over 97 countries. The Web version is fundamental to fulfilling the mission of the *NFM* to (1) keep current with technological advances and policy changes, (2) provide a citable source of USGS water-quality field methods that is readily accessible to the public, and (3) respond to user needs expeditiously.

Updating the *NFM* is an ongoing process that includes making any necessary revisions or corrections and incorporating new methods or information. Chapters or specific sections of chapters are systematically scheduled for review and revision. All proposed, past, and current changes are posted on the *NFM* "Comments and Errata" Web page. Over the last couple of years, the section in Chapter A6 on alkalinity was substantially revised and subsequently republished; the sections in Chapter A5 (Processing of Water Samples) dealing with samples for organic and inorganic carbon analyses have been revised to reflect a change in equipment; and updates of Chapters A2 (Selection of Equipment for Water Sampling) and A7 (Biological Indicators, including a new section on "Fecal indicator viruses") are nearing completion. New sections that are scheduled within calendar year 2003 include methods for processing samples for arsenic, low-level mercury, and wastewater substances analyses (Chapter A5) and collection of samples for analysis of *Cryptosporidium* and *Giardia* (Chapter A7). In addition, the section on turbidity in Chapter A6 is being rewritten and an index is being developed for the entire *NFM*. During FY 2003, a guidance document on the use of automated samplers is being drafted that will be incorporated into the *NFM* in the following year. Finally, a CD version of the *NFM* will be produced and available this fiscal year.

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## **Turbidity Workshop Summary**

**By: James Eychaner, U.S. Geological Survey, Western Region, 7801 Folsom Blvd, Ste 325, Sacramento, California 95826, [eychaner@usgs.gov](mailto:eychaner@usgs.gov)**

About 125 people from Federal agencies, universities, and equipment manufacturers attended a workshop on turbidity and other sediment surrogates in Reno, Nevada, during April 30 - May 2, 2002. Turbidity is an expression of the optical properties of a sample that causes light rays to be scattered and absorbed rather than transmitted in straight lines (ASTM D1899-00). This qualitative, bulk property of water is caused by the presence of suspended and dissolved matter, such as clay, silt, finely divided organic matter, plankton, other microscopic organisms, organic acids, and dyes. Each of these factors can be the objective of turbidity measurements or an interference to another desired objective. Estimation of suspended sediment concentration or any other variable from turbidity measurements requires a site-specific rating curve. The turbidity of suspended sediment mixtures, for example, differs for different mineral or organic materials and for different particle sizes or shapes.

Many instruments that use different light sources and detector geometries describe their output as 'turbidity' because each is calibrated to a standard, though artificial, suspension of formazin. Different instruments are preferred for different ranges of turbidity, but turbidity measurements of environmental waters are rarely equivalent between different instruments. For example, nine different types of turbidimeters were calibrated to identical standards at the workshop and used to measure three blind reference samples of suspended sediment. The standard deviation of measured turbidity ranged from 20 to 40 percent for the samples. Thus, the single most important factor in collecting useful turbidity records is to use a consistent instrument model and calibration process. Instruments should be calibrated to reference materials, not to the value observed with another instrument of a different model.

Secondary polymer standards for turbidity calibration also produce different readings in different instruments calibrated to the same primary formazin standards. Users of polymer standards should ensure the materials were prepared for the specific instrument to be calibrated. Preparing formazin from source chemicals requires precise and careful laboratory practice to achieve consistent results. Formazin suspensions are chemically safe to use and dispose of, but because the crystals can be a physical irritant to skin or eyes, normal laboratory protective measures should be used to prevent direct contact.

Workshop abstracts are available at <http://water.usgs.gov/osw/techniques/turbidity.html> and a summary publication is in preparation. A chapter of the National Field Manual will be written for turbidity measurements during 2003.

## **Hydrologic Instrumentation Facility - Testing Section Overview**

**By: Janice M. Fulford, U.S. Geological Survey, Hydrologic Instrumentation Facility, Stennis Space Center, Mississippi**

The Testing Section of the Hydrologic Instrumentation Facility (HIF) evaluates new instrumentation and validates instrumentation that can be rented or purchased from the HIF Field Services. The Testing Section has the capability to test and maintain water-level measurement devices, water-velocity meters, and water-quality instrumentation.

The Testing Section uses NIST traceable standards to verify or calibrate hydrologic instrumentation. Among the testing facilities available are:

- Environmental chambers (4) that control temperature and humidity for instrument testing;
- Stand pipe, a one-of-a-kind facility, that simulates varying water levels in a 100.5 feet high, 5 1/2 inch diameter groundwater well and that has external sampling ports located every 10 feet;
- Traceable pressure standards (3) that are used for pressure transducer validation and evaluation;
- On-site, stream-gauging station on the Pearl River that features an AC powered walk-in equipment shelter, stilling well, and pier equipment shelter;
- Hydraulic laboratory that includes a tow tank (12x12x450ft) capable of speeds from 0.03 to 18 fps, a jet tank used primarily for meter calibration and two large indoor tilting flumes that can be used to simulate stream flows;
- Outdoor flood plain simulation facility that is 300 ft wide, 3 ft deep, and approximately 4500 ft long ; and a
- Water-quality instrument laboratory equipped with vent hoods (3), drying ovens (2), temperature controlled recirculating water baths (3), NanoPure water system, incubator, explosion-proof refrigerator and flask washer.

Testing Section staff maintains over 400 multi-parameter rental-program water quality instruments. Standard parameters available include temperature, specific conductance, salinity, dissolved oxygen, and pH. Other parameters are available on request. The operation of every water-quality probe that is rented or purchased through the HIF is checked for proper operation and calibrated before being sent to the field. Testing Section staff also ensures that instrumentation stocked by the HIF meets manufacturer specifications and USGS specifications by routine quality assurance testing. At least 10 percent of all stocked instrumentation is tested. Water quality and pressure sensors are 100 percent tested before being rented or sold.

Instrument evaluations are conducted by three Testing Section projects that have ICOM oversight: Commercially Available Instrumentation, Submersible Pressure Transducers, and Water-Quality Instrumentation. Articles documenting Testing Section instrumentation evaluations are available on line in the HIF Instrument News Letter <http://www.hif.er.usgs.gov/uo/>

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### **Federal Interagency Sedimentation Project (FISP) Overview**

**By: Wayne O'Neal, U.S. Geological Survey, U.S. Army Corps of Engineers Waterways Experiment Station, 3909 Halls Ferry Rd, Vicksburg, Mississippi 39180, [woneal@usgs.gov](mailto:woneal@usgs.gov)**

The Federal Interagency Sedimentation Project (FISP) was created in 1939 by the following agencies: the U.S. Department of Agriculture, the U.S. Bureau of Reclamation (USBR), the Office of Indian Affairs, the U.S. Geological Survey (USGS), U.S. Army Corps of Engineers (USACE), and the Tennessee Valley Authority (TVA). The FISP was created to unify the research and development activities of Federal agencies involved in fluvial-sediment studies. Research conducted by FISP originally focused on hydraulic and mechanical aspects of sediment sampling, but has expanded to include development of sample-analysis methods, development of automatic in-situ analyzers, and sampling techniques and equipment for sampling water quality in streams and rivers. The equipment and techniques of FISP are the standards used by most Federal, State, and local governments, and private organizations collecting sediment samples in the United States. FISP-developed samplers have been used by the World Meteorological Organization as controls for comparison with suspended-sediment samplers developed in several foreign countries. In its 50-plus-year history, FISP and its staff have produced over 80 reports and papers. Most recent developments are the US DH-95, US D-95, US D-96, and US D-96-A1 samplers and the US SS-1 fluoropolymer (Teflon®) churn splitter.

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### **National Water Quality Laboratory Overview**

**By: Gary Cottrell, U.S. Geological Survey, National Water Quality Laboratory, Denver Federal Center, PO Box 25046, MS 407, Denver, CO, [cottrell@usgs.gov](mailto:cottrell@usgs.gov)**

This will be a brief description of recent NWQL activities and information on future initiatives. Items to be covered will include information on:

- Recently approved methods (Schedule 1404 *Organophosphorous Pesticides in Bed Sediment, Schedules for Arsenic Speciation, BTEX method*)
- New web tools; Sample Status Page, Income/Workload Page, plans for new Catalog
- Reminders about; shipping samples, how to contact NWQL, how we can help you to sell your project

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### **Safety, Everyone's Responsibility**

**By: Daniel Stanley, U.S. Geological Survey, Florida Integrated Science Centers, Ocala, Florida**

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### **Field Computing-Overview**

**By: Daniel J. Hippe, U.S. Geological Survey, Northeastern Region, Reston, Virginia**

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**Electronic Analytical Services Request Form (eASR)**

**By: Gary Cottrell, U.S. Geological Survey, National Water Quality Laboratory, Denver Federal Center, PO Box 25046, MS 407, Denver, CO, [cottrell@usgs.gov](mailto:cottrell@usgs.gov)**

Discussion and demonstration of the electronic ASR (eASR). This tool allows field personnel to create and save templates of ASR's, receive a unique ASR number, submit ASR information electronically to the NWQL, and print bottle labels. Use of the eASR will minimize data entry errors and provide a QC check for sample submission.

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**Personal Computer Field Forms (PCFF)**

**By: Frank Crenshaw, U.S. Geological Survey, 764 Horizon Drive, Room 125, Grand Junction, Colorado 81506, [fccrensh@usgs.gov](mailto:fccrensh@usgs.gov)**

Status of the PCFF software and introduction of a version for handheld PCs.

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**Techniques and Suggestions for Field Application of Microbial Source Tracking**

**By: Christopher M. Kephart, U.S. Geological Survey, 6480 Doubletree Avenue, Columbus, Ohio 43229, [ckephart@usgs.gov](mailto:ckephart@usgs.gov)**

Microbial source tracking (MST) is a relatively new and versatile suite of tools to relate fecal-origin water contamination to its sources. With sufficient sample data, these tools can be used to improve water-quality model inputs and, consequently, make significant contributions to public health preservation as well as aid in Total Maximum Daily Load (TMDL) development. To enable full use of complex and expensive MST technologies, field personnel must pay close attention to sample-collection protocol. Specifically, in regards to fecal samples, source-tracking results are compromised when the biological sample is not fresh, the sample is not preserved correctly, or the sample cannot be confidently associated with a source animal. Also, obtaining permission for feces-sample collection can be a delicate issue when negotiating with some landowners. Providing the necessary practical information is essential to handling questions and concerns these landowners may have. As is true for many other types of field applications, successful execution of source-tracking sampling plans would benefit from the unique experiences and suggestions of prior source-tracking investigators.

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**Autosampling for *Cryptosporidium***

**By: Rob Waschbusch and Steve Corsi, U. S. Geological Survey, 8505 Research Way, Middleton, Wisconsin 53562, [srcorsi@usgs.gov](mailto:srcorsi@usgs.gov); [rjwaschb@usgs.gov](mailto:rjwaschb@usgs.gov)**

*Cryptosporidium*, a parasite that attacks and multiplies in the gastrointestinal tract of humans, received explosive national attention during 1993 when *Cryptosporidium* oocysts entered the City of Milwaukee drinking water supply, causing the largest single waterborne disease outbreak ever documented. In the city and several surrounding communities, over 403,000 people experienced diarrhea and vomiting illness and 150 people died. This massive outbreak precipitated numerous watershed parasite occurrence studies showing the ubiquitous nature of this organism, which in turn raises concern about the potential for future outbreaks. Understanding the occurrence and variability of *Cryptosporidium* is critical to the production of a safe drinking water supply. Essential to this understanding is the ability to characterize potential sources of *Cryptosporidium* and predict their occurrence in a watershed. A recent 2-year *Cryptosporidium* study in Wisconsin showed that runoff events play a significant role in the introduction of oocysts to a watershed, which makes the use of automatic sampling methods attractive. The Wisconsin *Cryptosporidium* study collected 14 field blank samples, 25 field spike samples and several types of replicate samples. No oocysts were detected in any of the blanks. The mean recovery percentage of the field spikes was 33%, which was the same as the in-lab recovery results. The replicate sample results were inconclusive. The results from these samples indicate that automatic sampling methods are both practical and reliable for the collection of *Cryptosporidium* samples.

A current study in Wisconsin is using modified automatic samplers to collect samples for microorganism samples beyond *Cryptosporidium*. These modifications may be discussed in the presentation if time allows.

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**Colilert: A Different Method For *Escherichia Coli* Monitoring In The Chattahoochee River Near Atlanta, Georgia**

**By: Stephen J. Lawrence, U.S. Geological Survey, 3039 Amwiler Road, Suite 130, Atlanta, GA 30360, 770-903-9169, [slawrenc@usgs.gov](mailto:slawrenc@usgs.gov)**

Because of historically high levels of indicator bacteria in the Chattahoochee River, the concept of a bacteria alert network was proposed as a means to inform people when bacteria levels in the river exceed U.S. Environmental Protection Agency (USEPA) criteria. Thus, a program of bacteria monitoring called BacteriALERT was initiated on the Chattahoochee River within the Chattahoochee River National Recreation Area (CRNRA, National Park Service) in Fall 2000.

The CRNRA contains about three-fourths of all public green space in a 10-county area of Metropolitan Atlanta, Georgia and is visited by 2.9 million visitors with nearly 30 percent of those participating in water-based recreation. Within the CRNRA, drinking water and recreation are the designated uses.

A main objective of this effort is to collect and analyze water samples for total coliform and *Escherichia coli* (*E. coli*) bacteria at three sites on the Chattahoochee River upstream from Atlanta, Georgia, using a method that is easy to use, easy to teach, and minimizes contamination.

Water samples are collected daily using U.S. Geological Survey-approved methods. The samples are analyzed for *E. coli* in the bacteria laboratory at the USGS office in Atlanta, Georgia. The bacteria analysis for *Escherichia coli* is an enzyme substrate (or defined substrate) method called Colilert, which is analogous to the older multiple-tube fermentation method. The method is explicitly confirmatory for *E. coli* without the need for additional incubation on a different agar. Bacteria counts are expressed as a most probable number (MPN) per 100 milliliters (mL) of sample.

The Colilert method is easier and quicker to use than membrane filter methods, is less susceptible to analyst or laboratory contamination because there is less sample handling, and easier to determine the bacteria counts than membrane filter methods.

Generally three dilutions are used for each sample representing 50 mL, 10 mL, and 1 mL of sample (1:2, 1:10, and 1:100 dilution). Although at high turbidity levels the sample volumes used for a dilution range can be as low as 1 mL to 0.01 mL. Sterile deionized water is used for the dilution matrix because the buffer water normally used in the membrane methods interferes with the *E. coli* determination. A total of 100 mL of liquid is needed for each sample. A pre-packaged reagent powder is added to each dilution bottle, the bottle shaken to mix, allowed to sit for ten minutes then added to a plastic tray. The tray contains 97 plastic wells (or bubbles) of which 48 are small, 48 medium sizes, and one is large. The dilution bottle containing the dissolved reagent is added to the tray and the tray passed through a sealer that distributes the liquid to all 97 wells and heat seals the edges of the tray. The trays are incubated for 20 hours at 35 degrees Celsius. Wells positive for *E. coli* are yellow under ambient light and fluoresce under ultraviolet radiation. The number of positive small cells and the number of large positive wells determines the MPN for that dilution. The MPN for all dilutions for a sample are averaged to get the final sample MPN.

Quality control is maintained by using sterile technique, collecting duplicate samples, and analyzing split samples using membrane filtration methods. Total coliform, *E. coli*, and fecal coliform bacteria are intermittently analyzed using standard membrane filtration methods. Total coliform and *E. coli* filters are incubated in HACH's m-Colibblue24 broth. Extensive documentation is used to track the analysis of each sample and laboratory procedures such as sterilization of equipment and supplies and dilution water chemistry.

BacteriALERT web page: <http://ga.water.usgs.gov/bacteria>

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**Integrated Biological and Water-Quality Assessment of Nutrient-Enriched Streams in Texas.**

**By: Richard Kiesling<sup>1</sup>, Jeffery Back<sup>2</sup>, and Evan Hornig<sup>1</sup>**

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Understanding the linkage between aquatic life use impairment, macrobenthic invertebrate biocriteria, and water column and benthic algal production is critical to developing sound water quality assessment

procedures for nutrient-enriched streams. We are initiating a project to assess the linkages between periphyton and water column primary production, benthic macro-invertebrate community structure, and 24 hour dissolved oxygen data at a series of reference and impaired stream sites in Texas. Our integrated methodology is designed to document the pattern of nutrient limitation as well as the circumstances where water column and periphyton production play a role in DO-based impairment of aquatic life uses. Previous work using this methodology in the North Bosque River (NBR) Watershed has documented the pronounced impact of a nutrient enrichment gradient on aquatic communities and water quality. Preliminary efforts to document the impact of this enrichment on instream aquatic life has supported the hypothesis that biological impairment has occurred in at least two groups of organisms: algae and benthic macro-invertebrates. In situ experiments using Matlock periphytometers along the enrichment gradient identified nutrient saturated primary production by periphyton as one response to the loadings. Comparative sampling of benthic invertebrate communities has identified a second impact: moderate to severe impairment of benthic communities along the enrichment gradient compared to reference conditions.

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### **Ecological Studies In The National Water-Quality Assessment Program: An Operational Perspective On Field Protocols**

**By: Stephen R. Moulton II, U.S. Geological Survey, Biological Operations Manager, National Water-Quality Assessment Program, Reston, Virginia 20192, [smoulto@usgs.gov](mailto:smoulto@usgs.gov)**

In 2001, the National Water-Quality Assessment (NAWQA) Program began its second decade of studies. Ecological studies are being conducted to assess long-term-trends in water quality and as part of nationally guided studies addressing selected water-quality issues (for example, nutrient enrichment and urbanization). Sampling for these studies is carried out within a defined length of stream, or "reach," which provides a common spatial scale to which biotic and abiotic factors influencing water quality can be related. Protocols for sampling biological communities (algae, invertebrates, and fish) and conducting habitat assessments are used in these studies to ensure consistent, national application of methods across a wide range of aquatic ecosystems. These protocols were developed specifically for the NAWQA Program and assume a relatively high-degree of professional knowledge and decision-making capability. Protocol specific training exercises and mentoring opportunities compliment and support the goal of maintaining national consistency. Protocols for sampling biological communities were recently (2002) revised and published; protocols for conducting habitat assessments were revised in 1998. The revised biological sampling protocols incorporate the knowledge gained from over 10 years of application in the program and they are organized and presented in a streamline, user-friendly format. These protocols describe quantitative and qualitative sampling methods for algae and invertebrates including procedures for processing samples in the field prior to taxonomic analysis. The fish sampling protocols present two complimentary methods (electrofishing and seining) for obtaining a representative sample of fish community in the stream reach. Special protocol considerations such as safety, training, sampling permissions, and shipping samples to laboratories are identified as topics for further discussion during the NAWQA panel discussion at the conference. The NAWQA ecological protocols are available in PDF form at [http://water.usgs.gov/nawqa/protocols/doc\\_list.html](http://water.usgs.gov/nawqa/protocols/doc_list.html).

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### **U.S. Geological Survey, Office of Water Quality, NAWQA National Synthesis Project**

**By: David K. Mueller, U.S. Geological Survey, Lakewood, Colorado 80225, [mueller@usgs.gov](mailto:mueller@usgs.gov)**

Cycle I of the U.S. Geological Survey's National Water Quality Assessment Program began in 1991 and was recently completed. During Cycle II, which began in 2001, investigations are continuing in 42 study units. Design of the Cycle II NAWQA Program was overseen by a National Implementation Team (NIT). In November 2000, the NIT produced a document outlining Study Unit Design Guidelines. The primary goals of the Program during Cycle II continue to be:

- Provide a nationally consistent description of current water-quality conditions for a large part of the nation's water resources. [*Status*]
- Define long-term trends (or lack of trends) in water quality. [*Trends*]
- Identify, describe, and explain, as possible, the major factors that affect observed water-quality conditions and trends. [*Understanding*]

However, the emphasis in Cycle II has shifted from Status tasks, such as occurrence and distribution surveys, to Trends and Understanding tasks. This shift has significant implications for sample collection. Much Status sampling has been dropped, though some has been added to cover resources previously

not sampled. Trends sampling has changed to give more temporal coverage at fewer stream sites and groundwater study areas. A number of topical studies will address various Understanding issues, and will require intensive sampling and new analytic schedules. In addition to these changes, there are sampling issues that involve new or revised protocols, new equipment, and changes to technical support. It is important for NAWQA study unit staff to know the rationale for all these changes so they can understand the Cycle II sampling design.

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**Decreasing Detection Limits for Dissolved and Particulate Elements in Marine Waters of New York Harbor**

**By: Anthony Paulson, Ph.D., P.G., Washington Water Science Ctr., 1201 Pacific Ave., Suite 600, Tacoma, WA 98402 (253) 428-3600 ext. 2681, [apaulson@usgs.gov](mailto:apaulson@usgs.gov)**

As the U.S. Geological Survey becomes more involved in coastal issues, analyses of metals in estuarine coastal waters could become an increasingly important task in many coastal Districts. Advanced ultra-trace element instrumentation and procedures used in the 2000's are contrasted with methods developed at the onset of ultra-trace method analyses in the early 1980s. After working at hazardous waste sites during much of the mid-1990s, the author returned to ultra-trace techniques in 1998 and found smaller-scale field and lab equipment being utilized in estuarine and coastal studies. Limited technical and fiscal resources required that the sources of contamination during sampling and processing be more quickly identified and eliminated prior to field sampling. Previous ultra-trace metal experience suggested that analyses of zinc (Zn) were highly sensitive to metal contamination, and improvements in Zn detection limits invariably led to decreased detection limits of most other metals. Development of field protocols prior to use in geochemical study of the New York Harbor utilized Zn as the surrogate for metal contamination from collection bottles, filters and filtering apparatus. Significant decreases in the level of contamination for Zn and other elements were achieved in the second season of field sampling by changing procedures for acid-cleaning syringes, by pre-testing each filter/syringe assembly, by transporting samples back to the clean lab for filtration, and by changing the desiccant for drying filters to sodium hydroxide. These decreases in detection limits allowed the project to meet the geochemical objectives of the sampling of the New York Harbor complex.

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**Methods and Utility of Snowbank Sampling: Sampling Snowbanks on Urban Streets, Parking Lots, and an Airport in Milwaukee, WI**

**By: Steve Corsi, U. S. Geological Survey, , 8505 Research Way, Middleton, Wisconsin 53562, [srcorsi@usgs.gov](mailto:srcorsi@usgs.gov)**

Samples were collected to compare toxicity and snow quality in snowbanks from within an airport to snowbanks from typical urban land uses. In addition to sampling the primary snowbank that was adjacent to the terminal ramp, samples were collected from snowbanks along side city streets in industrial and residential areas and from commercial parking lots. Within the airport, front-end loaders cleared corridors into the snowbank to allow access for sampling. Other urban snowbanks were accessed with shovels. Samples were analyzed for Microtox toxicity, COD, conductivity, and chloride. In addition, airport samples were analyzed for propylene and ethylene glycol (the primary components of aircraft deicer). Topography of the airport snowbank was surveyed to estimate a total snow volume. In order to estimate total water content of the snow, core samples of a known volume were collected, melted, and measured. Total glycol content in the airport snowbank was computed with resulting data.

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**Field Methods for Mercury Sampling for Water**

**By: John DeWild, U. S. Geological Survey, , 8505 Research Way, Middleton, Wisconsin 53562, [jfdewild@usgs.gov](mailto:jfdewild@usgs.gov)**

To better understand the fate and transport of mercury in the environment the Wisconsin District Mercury Lab has participated in numerous projects involving stable isotope additions to natural environments. As a result of this work we have modified two common water sample collection practices to conform to the ultra-clean requirements necessary when dealing with environmentally relevant mercury concentrations. A vacuum filtration system that uses only Teflon components is used to separate the suspended sediment fraction from the dissolved fraction. Each of these fractions can then be analyzed for mercury content. The other area of interest for the mercury team is the transport of mercury during runoff events. An ISCO automated sampler has been modified to collect composite samples during runoff events in areas where unattended sampling is necessary.

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## **Use of an Uplooking ADCP for Estimating Sediment in the Tidal Hudson River, NY**

**By: Gary Wall and Elizabeth Nystrom, U.S. Geological Survey, 425 Jordan Rd, Troy, NY 12180, [grwall@usgs.gov](mailto:grwall@usgs.gov); [nystrom@usgs.gov](mailto:nystrom@usgs.gov)**

The NY District has installed an uplooking acoustic Doppler current profiler (ADCP) in the tidal portion of the Hudson River just south of Poughkeepsie, NY. Uplooking measurements of velocity and acoustic backscatter are being correlated with discharge and suspended sediment concentration respectively to estimate downstream sediment flux in near real time. Data collection, transfer and processing will be discussed.

## **Results and Discussion of NAS-2E and EcoLAB Nutrient Analyzer Deployments**

**By: Peter F. Rogerson, U.S. Geological Survey, Office of Water Quality, Lakewood, Colorado 80225, [rogerson@usg.gov](mailto:rogerson@usg.gov)**

The WS EnviroTech NAS-2E nutrient monitor was deployed at the Clear Creek Supergage for 3 days in June, 2001. Results of nitrate determinations showed a strong diurnal variation in nitrate concentration. The new, multichannel EcoLAB nutrient monitor was deployed at the Supergage for 4 days in August, 2002. Results of nitrate and phosphate determinations showed less diurnal variation. An 3 week deployment of the EcoLAB monitor determined nitrate and phosphate in Klamath Lake, OR. Experiences, results, problems, and pro's & con's of the 2 analyzers will be discussed.

## **Continuous Monitoring and Sampling for Zinc and Other Parameters in Streams**

**By: Thomas Chapin and Richard Wanty, U.S. Geological Survey, MS 973, Denver Federal Center, Denver, CO 80225, [tchapin@usgs.gov](mailto:tchapin@usgs.gov) and [rwanty@usgs.gov](mailto:rwanty@usgs.gov)**

**Presenter: Richard Wanty**

Historically, most investigations of biogeochemical cycling in acid rock drainage systems have involved synoptic sampling over longer time periods (one sample per week or month) or intensive time series studies over a few hours or days. However, many important episodic loading events, such as seasonal meltwater events and storm events occur on timescales that are rarely observed by these traditional sampling approaches. Monitoring these transient processes, which may contribute the bulk of the annual metal loading, is essential for accurate assessment in acid rock drainage areas. Recent work also has demonstrated dramatic diel variations in trace metal concentrations in response to diel changes in temperature, pH, oxygen, and photochemical cycling (Brick and Moore, 1996, McKnight et al., 2001, Nimick et al. in press). To characterize a system that may respond to diel, seasonal, and episodic events, a monitoring program must sample at a frequency that captures the details of these major forcing events.

To examine low and high frequency temporal changes in acid rock drainage areas, we have developed two novel instruments, the Zn-DigiScanner and the DigiSampler. The Zn-DigiScanner is a battery powered submersible chemical analyzer designed for long term deployments with hourly analyses of Zn. In-stream physical parameters (temperature, conductivity, dissolved oxygen, pH, turbidity, etc) were measured every 15 minutes with a YSI Sonde 6600. The DigiSampler was developed for the long-term daily sampling of biogeochemically active elements and can take either discrete samples or samples integrated over 24 hours. The DigiSampler collects 2 mL samples in a Teflon coil, which are separated by 0.2 mL nitrogen bubbles. The sample coil is returned to the lab and the 2 mL samples are diluted 1:10 and analyzed for trace metals by ICP-MS.

Initial results from a 3-day deployment at Fisher Creek, MT have successfully demonstrated the ability of the Zn-DigiScanner to record Zn concentrations at levels below 100 µg/L. Zinc concentrations in Fisher Creek showed a diel cycle with low values of ~25 ppb in the late afternoon and increasing to ~60ppb by early morning. Zn concentrations were inversely related to temperature and pH, suggesting that temperature and pH-dependent adsorption were the main factors controlling diel Zn fluctuations.

Initial deployment of the DigiSampler was also successful, revealing diel cycles in Zn, Cu, and Mn. Comparison of trace metal samples collected by the DigiSampler showed good agreement with samples collected by an Isco sampler, demonstrating that the DigiSampler can collect clean samples for trace metal analysis at the low ppb range.

### **Real-time Atmospheric Mercury Speciation**

**By: Mark Olson, U. S. Geological Survey, , 8505 Research Way, Middleton, Wisconsin 53562, [mlolson@usgs.gov](mailto:mlolson@usgs.gov)**

Mercury in the atmosphere is found primarily in the elemental form and has been measured for several years. Recently scientists have developed the ability to monitor Particulate Mercury and Reactive Mercury in the atmosphere, which come primarily from anthropogenic sources. Particulate and Reactive Mercury species have a much shorter residence time than Elemental Mercury due to higher removal rates by wet and dry deposition, and therefore remain in higher concentrations closer to the point sources.

The Wisconsin District Mercury Laboratory (WDML) has recently purchased an instrument with the ability to measure Elemental, Reactive, and Particulate Mercury on a continuous basis and will be looking at levels of atmospheric mercury species in several locations across the United States. The first location was a non-impacted rural Southern Wisconsin site where background concentrations were observed. The second location was in East St. Louis, Illinois where concentrations of two times background concentrations were typical and several extreme spikes of all three species were observed.

A trailer is being purchased and modified by the WDML and the instrument will soon be able to be set up in remote locations where power is unavailable.

This presentation will demonstrate the principles of operation of the instrument, challenges faced with deployment and data from rural Wisconsin and East St. Louis.

### **Application of the ELIZA Field Assay for Atrazine**

**By: Howard W. Reeves and Brian P. Neff, U.S. Geological Survey, 6520 Mercantile Way, Suite 5, Lansing, Michigan 48911-5991, [hwr Reeves@usgs.gov](mailto:hwr Reeves@usgs.gov); [bpneff@usgs.gov](mailto:bpneff@usgs.gov)**

The St. Joseph River has been identified as contributing the largest load of atrazine to Lake Michigan, but the dynamics of atrazine transport in the St. Joseph River basin are unknown. Atrazine is a common herbicide that has been identified as a contaminant of concern by EPA, as an emerging pollutant by the Lake Michigan Lake Wide Management Plan, and has recently been associated with feminization of male frogs in the wild. Since ninety percent of the flow of the St. Joseph River originates as ground-water discharge to the river, ground water may play an important role in the transport of atrazine. There is no direct evidence, however, to confirm this hypothesis.

Surface and pore water samples were collected at 30 locations throughout the St. Joseph basin and analyzed using the immunoassay (ELIZA) technique. The results of this analysis will be used to help locate appropriate locations for future study transects. Intensive sampling of ground water, surface water and pore water along transects will help reveal the importance of ground water in the transport of atrazine. The 2001 and 2002 samples revealed that atrazine was found throughout the basin above the detection limit of 0.05 ppb. Surface and pore water concentrations did not correlate at all stations. Measured concentrations were highest in the late spring after application of atrazine, which is typically at or immediately after planting. The values at most surface water stations were non-detect just before planting in 2002. The advantages of the ELIZA method were lower cost compared to laboratory analysis and same-day analysis that may be used to screen sites for intensive sampling and laboratory analysis.

### **Modification of an ISCO 6700 Autosampler for Pesticide Analysis**

**By: Mark W. Sandstrom, U.S. Geological Survey, National Water Quality Laboratory, P.O. Box 25046, MS 407, Denver, Colorado, 80225-0046, [sandstr@usgs.gov](mailto:sandstr@usgs.gov)**

We're modifying a commercial autosampler to allow determination of low-concentrations of pesticides in stream samples during run-off events. The autosamplers will be used in the NAWQA ACT topical studies. The modifications include use of Teflon sampling tubing, replacement of the peristaltic pump with a ceramic piston-cylinder pump, and fluorinated HDPE sample bottles. An overview of the project, description of the autosampler, and preliminary results of validation samples will be presented.

## **The Use of Automatic Samplers for Collecting Storm Pesticide Samples in an Urban Setting: "You Miss Lot if You Don't Use Them"**

**By: Pat Phillips, G. R. Wall, and D. D. Edwards, U.S. Geological Survey, 425 Jordan Rd, Troy, New York 12180, [pjphilli@usgs.gov](mailto:pjphilli@usgs.gov); [grwall@usgs.gov](mailto:grwall@usgs.gov); [dedwards@usgs.gov](mailto:dedwards@usgs.gov)**

As part of a cooperative study focusing on storm-runoff of pesticides, the New York District has been operating three automatic sampling sites in small (less than 25 square mile) suburban watersheds for the last few years. Samplers are operated in order to minimize the likelihood of cross-contamination of samples: 1) sample lines are purged twice before sampling, and 2) four 1-L glass bottles are filled per sample, with the first 1-L bottle used for rinsing filter equipment in the laboratory. Teflon tubing (which is changed annually) is used for intake lines, but non-teflon tubing is used for the pump head tubing and distributor arm tubing. Before use, pump head tubing and distributor arm tubing are washed using NAWQA protocols, with the exception that blank water is used as a final rinse instead of methanol; these are changed after every sampling event, and are not reused. Glass bottles (washed according to NAWQA protocols) are used for sample collection. Eleven Blanks collected at 1) intake lines, 2) used pump head and distributor arm tubing, and 3) sample bottles at a site showed no detection for SH2010 constituents, and minor detections for two SH2060 compounds (Caffeine and imazethapyr). The detected concentrations of the two SH2060 compounds in the blank samples were either 25 times less than the environmental concentration, or were for compounds not detected in the environmental sample. Replicates between equal width and point samples had concentration differences similar to that for normal replicates, and comparisons between equal width and point samples indicated no significant differences. The data generated by this study have shown the importance of storms (including late-fall events) in transporting pesticides in these watersheds.

### **Catching the Storm**

**By: Charles Heavener, U.S. Geological Survey, 401 Hardin Road, Little Rock, Arkansas 72211, [heavener@usgs.gov](mailto:heavener@usgs.gov)**

As more emphasis is being placed on the fate and transport of material during stormflow, more water-quality monitoring programs are requiring stormflow sampling. The Arkansas District currently samples stormflow at 14 sites. Water-quality data gathered from these samples are used to calculate constituent loads and yields. Water samples are collected manually; no automatic samplers are used at this time with the exception of two daily sediment stations. Sampling these randomly occurring storm events requires extensive preparation and foresight. Accessibility (at work and at home) to real-time weather conditions, local rainfall intensity, and streamflow associated with each site is necessary. Knowledge of available off-duty personnel is required for overnight and weekend trips. Overtime is essential. Safety is top priority. With proper planning and communication, sampling storm events at multiple sites for multiple projects can be accomplished.

### **Recent Studies Assessing Discrete-Interval Samplers and Direct-Push Monitoring Wells**

**By: L. V. Parker (ERDC CRREL), M.E. Kram (NFESC), and W. Major (NFESC), U.S. Army Engineer Research And Development Center, Cold Regions Research and Engineering Laboratory, USA/ERDC/CRREL, 72 Lyme Rd, Hanover, NH 03755, [lparker@crrel.usace.army.mil](mailto:lparker@crrel.usace.army.mil)**

The results from two different studies will be presented. One study, funded by the Army Environmental Center, examined the ability of five discrete-interval type samplers to recover representative concentrations of a variety of organic and metal analytes. The other study, funded by ESTCP, is a multi-site (5), multi-year evaluation of the long-term use of direct-push monitoring wells. This effort is currently headed by the Naval Facilities Engineering Service Center (NFESC).

The devices tested in the discrete-interval study were the Kabis, HydraSleeve, Discrete Interval and USGS Passive Diffusion Bag samplers, and the Pneumo-Bailer. In the first phase of this study, the samplers were tested for their ability to recover known concentrations from a standpipe. Analytes of concern included volatile organics, explosives, pesticides, and metals. In the second phase of this study, these devices were tested for their ability to recover representative concentrations of TCE from a deep monitoring well. Concentrations from the devices were compared with concentrations of samples taken using low-flow sampling.

Sites included in the direct-push study include Tyndall Air Force Base, Port Hueneme, Dover Air Force Base, Hanscom Air Force Base, and the Army's Cold Regions Research and Engineering Lab (CRREL). In the first phase of this study, the first four sites were sampled five times over 18 months. The results from the statistical analyses conducted on the organic, inorganic, and field parameter data will be presented. The CRREL site was included in this study because of its challenging terrain and depth to ground water (up to ~135'). Issues and findings from the CRREL site will also be presented, along with a discussion of future plans and concerns for the second phase of this study.

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#### **Microelectrode Technology Applied in the Environment**

**By: Tracey A. Spencer<sup>1</sup>, Michelle M. Lorah<sup>1</sup>, and Isabelle M. Cozzarelli<sup>2</sup>**

**USGS Toxics Substances Hydrology Program**

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Characterization of reduction-oxidation reactions is critical in evaluating the fate of organic contaminants and metals in the environment. Electrochemically active reduction-oxidation constituents were measured *in situ* without the removal of water or sediment samples using a voltametric microelectrode system. As part of a USGS Toxics Substances Hydrology Program Project at the Norman Landfill, Norman, Oklahoma, the microelectrode system was adapted and tested for measurements of reduction-oxidation constituents in wetland and stream-bottom sediments. The microelectrode was implemented at the Norman Landfill to: (1) characterize the distribution of major reduction-oxidation species in a slough during one sampling event; and (2) identify potential tracers of leachate contamination in a slough. The voltametric system consists of an electrochemical analyzer and three microelectrodes. The three microelectrodes are comprised of a silver/silver-chloride reference electrode, a platinum counter electrode, and a 100-micrometer gold/mercury-working electrode. These electrodes were used in conjunction with a micromanipulator, which pushed the working electrode into the sediment sampling media in increments of millimeters to obtain detailed vertical depth profiles of reduction-oxidation constituents. Simultaneous measurements of dissolved oxygen, iron, manganese, and sulfide were collected using this microelectrode technology.

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#### **Pore Water Sampling Methods of Water Quality Parameters in the Everglades Mangrove Estuaries**

**By: Gordon Anderson<sup>1</sup>, Fara Ilami<sup>2</sup>, Thomas J Smith<sup>3</sup>, Suzanne Chwala<sup>4</sup> and Christa Walker<sup>5</sup>**

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In April 1997, a pore water salinity and temperature sampling regime was established along a 300 m boardwalk near the Harney River, an estuary river located in Everglades National Park. Five regularly spaced, soil pore water sampling sites (SW1-5) were placed along the boardwalk. Each site was sampled for salinity/specific conductances and temperature every week for the first year and then biweekly in subsequent years (1997-present). Pore water sites SW1-3 were located near the river bank (SW1) outwardly through the mangrove fringe forest, site SW4 was set in the sawgrass-mangrove interface and site SW5 was placed in an interior coastal marsh. At each soil pore water-sampling site, three replicate tubes were installed to sample pore water at 30 cm and 60 cm depths. In July 2002, it was determined that to better evaluate the soil/vegetation dynamics along the mangrove fringe forest, additional organic and inorganic water quality parameters were needed. Two sample periods (July and August 2002) were done at the five sites for an array of organic and inorganic water chemistry parameters. WQ analysis was done either in the field or at the USGS Water Quality Laboratory in Ocala Florida in accordance with the USGS methods. This presentation documents the pore water sampling design, field sampling process and evaluation of the initial water quality data collected.

## **The Use of Passive Bag Samplers in Ground-Water Quality Investigations**

**By: Don Vroblesky, Research Hydrologist ([vroblesk@usgs.gov](mailto:vroblesk@usgs.gov); 803-750-6115)**

**Presenter: Celeste Journey, Water-quality specialist ([cjourney@usgs.gov](mailto:cjourney@usgs.gov); 803-750-6141)**

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Passive Diffusion Bag sampler employs patented technology that consists of a low-density polyethylene sleeve, filled with laboratory-grade deionized water and closed at both ends. Typical applications of passive diffusion bag samplers include long-term monitoring of volatile organic compounds (VOCs) in wells and delineation of contaminant stratification. Data obtained from passive diffusion bag samplers can aid in site characterization and more accurate identification of the contaminated horizon.

Passive diffusion bag sampling is a desirable alternative to conventional sampling methods because it (1) uses samplers that are inexpensive (typically 40-60 percent cost savings over conventional methods); (2) is rapid and easy with minimal field equipment required; (3) samplers are disposable, so equipment decontamination cleaning is not needed between wells; (4) potentially can eliminate pumps and reduce waste water; (5) sometimes can provide information difficult to obtain with conventional methodologies; (6) is practical for use when access is a problem or discretion is desirable; and (7) is not subject to interferences from alkalinity or turbidity.

Passive diffusion bag samplers are deployed in the screened interval and allowed to equilibrate. After a sufficient equilibration period, the samplers are removed and the enclosed water is transferred to volatile organic analysis (VOA) vials. Thereafter, the samples are treated as ordinary VOA samples. The data indicate that the of passive diffusion bag samplers equilibrate rapidly to the tested VOCs (48 to 166 hours). However, the samplers should be left in place long enough for the well water, the contaminant distribution, and the flow dynamics to re-stabilize following sampler deployment. Because these factors can be quite different among wells, restabilization of these factors can range from minutes to hours to days. As a simple guideline, a minimum equilibration time of two weeks should be adequate for most wells in permeable formations. In poorly permeable formations, even longer equilibration times may be needed.

Laboratory and field tests are discussed that describe the applicability of passive diffusion bag samplers to a wide variety of volatile organic compounds and compare VOC concentrations from passive diffusion bag samplers and from conventional sampling method, such as low-flow and 3-casing-volume purge-and-sample techniques. Additional work in progress is described that examines passive samplers for constituents other than VOCs.

## **Using Multiple Tracers and Novel Geophysical Tools to Study Ground-Water Discharge at Indian River Bay, DE**

**By: Peter Swarzenski, U.S. Geological Survey, 600 4th Street South, St Petersburg, Florida 33701, [pswarzen@usgs.gov](mailto:pswarzen@usgs.gov)**

## **Borehole Flowmeters, Liners, And Packers For Discrete-Zone Sampling In Ground-Water Quality Studies**

**By: John H. Williams<sup>1</sup> and Carole D. Johnson<sup>2</sup>**

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Boreholes that intersect multiple aquifer zones provide a short circuit to the ground-water flow system. Under ambient conditions, flow occurs in the boreholes from zones of higher hydraulic head to zones of lower head. The collection and interpretation of ground-water quality samples from multi-zone boreholes are not straightforward. The source of water for a pumped sample is dependent on the transmissivity and head of the zones, wellbore storage, and discharge rate and period. Low-flow and passive-bag sampling methods will not sample water from the lower-head aquifer zones. Even traditional purging-and-sampling methods will not sample water from these zones if the pumped rate is not adequate to overcome the ambient head difference. Borehole cross connections may spread contaminants to an uncontaminated zone or dilute contaminants in a contaminated zone.

High-resolution flowmeters can be used to measure ambient and pumped flow in multi-zone boreholes to help evaluate the source of water samples and the effects of cross connection of aquifer zones.

Borehole liners and packers can be used to isolate discrete zones and obtain representative water-quality samples if sufficient time is allowed for flushing of cross-connection effects.

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### **Revised Guidelines for the Operation of Continuous Water-Quality Monitors**

**By: Richard J. Wagner, Washington Water Science Ctr., 1201 Pacific Ave., Suite 600, Tacoma, Washington 98402 (253-428-3600 ext. 2685) [rjwagner@usgs.gov](mailto:rjwagner@usgs.gov)**

Guidelines and standard procedures for continuous water-quality monitors: sites selection, field operation, calibration, record computation, and reporting (Wagner and other, 2000) is a quality-assurance plan for the operation of continuous water-quality monitors that describes five major quality-assurance concepts: (1) a standard protocol for servicing monitors, (2) calibration criteria, (3) data-correction criteria, (4) maximum allowable limits, and (5) a rating of accuracy.

Three major changes highlight the planned revisions to the guidelines: (1) addition of protocols for servicing water-quality monitors in environments with changing physical properties (such as temperature, dissolved oxygen, or specific conductance); (2) application of water-quality fouling corrections by percentage rather than as datum corrections; and (3) implementation of as many as three 3-point data-correction curves that are applied simultaneously. No changes are made for the last four concepts of the guidelines.

Additional protocols have been added for servicing monitors in changing environments, estuarine environments, or deep ground-water wells. The standard protocol for servicing monitors describes water-quality monitor operation in a stable, unchanging environment. The revised guidelines include two variations of the standard protocol for servicing – one to be used in a slowly changing environment to realize any in-stream changes that may occur during the cleaning process and one to be used in a dynamic, rapidly changing environment.

The guidelines describe a fouling correction that is generally applied as a datum correction the last time the sensor was cleaned, at the last rise in gage height, or from a significant event noted in the field notes. However, application of a datum correction can be misleading if there is a large range in environmental values. Therefore, the revision recommends that data corrections for fouling be made by percentage rather than arithmetically.

Data corrections are applied to recorded water-quality data to compensate for erroneous recordings. Most data corrections are needed because of instrument fouling or sensor drift. Previously, the National Water Information System (NWIS) allowed only a 1-point datum correction and a 3-point variable shift. The new version of NWIS (v. 4.2) gives the user the option of using as many as three sets of 3-point data-correction curves.

Wagner, R.J., Matraw, H.C., Ritz, G.F., and Smith, B.A., 2000, Guidelines and standard procedures for continuous water-quality monitors: sites selection, field operation, calibration, record computation, and reporting: U.S. Geological Survey Water-Resources Investigations Report 00-4252, 53 p.

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### **Utilizing New Dissolved Oxygen Sensing Technology to Minimize Servicing Trips**

**By: James R. Jeffries, U.S. Geological Survey, #4 Braddock Square Mall, LaVale, Maryland 21502, [jeffries@usgs.gov](mailto:jeffries@usgs.gov)**

Recent technological developments in the field of dissolved oxygen sensing have made exciting advancements in the field of continuously monitoring that parameter. Past long-term, continuous dissolved oxygen monitoring efforts have been plagued by probe fouling problems which required very frequent servicing visits which caused the monitoring of this parameter to be very costly and labor intensive. Diffuser rod technology extends the servicing interval at dissolved oxygen monitoring sites from days to weeks at both fresh water and estuarine (brackish) environments. This technology also eliminates the need for stirrers at low or no velocity deployment sites.

## **Deployment and Testing of the Greenspan AQUALAB Analyzer at the Morgan Creek NAWQA Trend Site in the Chesapeake Bay Watershed**

**By: Michael J. Brayton, Hydrologist, U.S. Geological Survey, 8987 Yellow Brick Road, Baltimore, Maryland 21237, [mbrayton@usgs.gov](mailto:mbrayton@usgs.gov)**

Records of water quality and flow variability over the scale of a single day or single storm event provide valuable insight into hydrologic and hydrochemical processes in a watershed. At Morgan Creek, a small stream draining an agricultural watershed on the Delmarva Peninsula, dissolved oxygen, pH, turbidity, specific conductance, water temperature and selected nutrients are measured using an AQUALAB<sup>1</sup> streamside field analyzer. Unlike traditional auto-samplers, the analyzer performs actual on-site chemical analyses for dissolved but non-filtered nutrients including nitrate, ammonia, and total reactive phosphate. A pumped sample from the stream is measured hourly for physical parameters and analyzed every 6 hours for nutrients. Sensor calibrations are automatically performed before each nutrient measurement and twice daily for all physical parameters. During a 10-week evaluation, independent measurements of physical stream parameters generally agreed with measurements by the analyzer. Nutrient concentrations measured by the AQUALAB are generally within 5 percent of concentrations reported for laboratory analysis of replicate samples.

<sup>1</sup>The use of firm, trade, or brand names is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

## **Real-time Tail Water Temperature and Dissolved Oxygen Monitoring**

**By: Janelle Jones Heavener, U.S. Geological Survey, 401 Hardin Road, Little Rock, Arkansas 72211, [jaiones@usgs.gov](mailto:jaiones@usgs.gov)**

The White River in northern Arkansas and southern Missouri has five major impoundments (Beaver, Table Rock, Bull Shoals, Norfork, and Greers Ferry Lakes), each supporting a tailwater trout fishery. The Arkansas and Missouri Districts have and continue to operate real-time water-quality (temperature and dissolved oxygen) monitors in and below these five dams from June 1 through December 31, annually. Instrument calibration is scheduled every two weeks between June 1 and July 31, weekly between August 1 and November 14, and every two weeks between November 15 and December 31. Working the data records occurs almost daily. Data are used by Southwestern Power Administration and U.S. Army Corps of Engineers to regulate power generation when dissolved oxygen concentrations drop below 6 mg/L and again at 3.0 mg/L. Data are used by Arkansas Game and Fish Commission and Missouri Department of Conservation to evaluate ambient temperature and dissolved oxygen conditions for trout stocking. Operation and maintenance of these instruments and the delivery of these data are critical to dam operations and the tailwater fishery programs.

## **Automated Salinity Alert for the Cooper River--Integration of Real-time Data, Animation, and Digital Notification**

**By: Paul A. Conrads, U.S. Geological Survey, 720 Gracern Rd, Ste 129, Columbia, SC 29210, [pconrads@usgs.gov](mailto:pconrads@usgs.gov); and Uwe Mundry, Advanced Data Mining, Greer, SC**

The Cooper River is formed by the confluence of the West and East Branches of the Cooper River and flows 50 miles to Charleston Harbor. The Cooper River is tidally affected throughout its entire reach. The freshwater inflows to the West Branch are controlled by the releases from Pinopolis Dam on Lake Moultrie. Saltwater in the Cooper River extends from the Harbor upstream to several miles below the confluence of the West and East Branches. The Bushy Park Industrial area was established along the east bank of the Back River and the West Bank of the Cooper River. To provide water to the industrial users, a freshwater reservoir was constructed by damming the Back River at the lower end near the confluence with the Cooper River. Durham Canal (by Station 02172040, fig. 1) was constructed as a conduit between the upper end of the reservoir and the freshwater part of the Cooper River.

The South Carolina District of the U.S. Geological Survey has maintained a real-time specific conductance monitoring system on the Cooper River since the 1980s to provide a warning system for potential salinity intrusion in the vicinity of Durham Canal. Advances in digital communication and visualization techniques enabled the development of an automated salinity alert software package, ADMWatch, which integrates real-time data, animation, and digital notification. ADMWatch automatically retrieves specific conductance data from eight stations on the Cooper River, West Branch Cooper River, and Durham Canal, performs error checking on the data, creates animation showing the location of salt

front as a plan view and as a function of river mile. Specific conductance thresholds are set in the program and when thresholds are exceeded email notification is sent to the cell phone or digital pager of the appropriate personnel. The software demonstrates how real-time data and advanced visualization techniques can be integrated to facilitate the operation of a salinity alert system.

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**Use Of Continuous Monitors To Document Chloride And Sulfate Loads Downstream Of Salt Diversion Structures, South Wichita River, North Texas**

**By: Mick Baldys, U.S Geological Survey, 3010 Buchanan Street, Wichita Falls, Texas 76308, sbaldys@usgs.gov**

Naturally occurring salt springs in the headwaters of the Red River and some of its tributaries in Texas severely affect the water quality of the Red River rendering its waters unusable for drinking water supplies. The U.S. Army Corps of Engineers, which began studying the issue in 1957, started constructing salt diversion structures in 1974 in the South Wichita River, a tributary to the Red River; the first structure became operational in 1987. The salt diversion structures remove highly saline flows from the river by capturing low flows behind an inflatable dam and piping them to an evaporation pond. During high flows, the dam is deflated allowing saline water diluted by runoff to pass downstream. The U.S. Geological Survey constructed stations to continually measure discharge and specific conductance of the downstream flow. Discrete samples for dissolved chloride and sulfate concentrations are collected throughout the year. Regression equations were developed that relate chloride and sulfate concentrations to specific conductance from which salinity loads are computed. Water quality in the Wichita River Basin appears to be improving with salinity loads decreasing over time.

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**Real-time Continuous Monitoring of Water Quality in Kansas Streams**

**By: Victoria G. Christensen, Andrew C. Ziegler, Patrick P. Rasmussen, and Xiaodong Jian, U.S. Geological Survey, 4821 Quail Crest Place, Lawrence, Kansas 66049, [vglenn@usgs.gov](mailto:vglenn@usgs.gov); [aziegler@usgs.gov](mailto:aziegler@usgs.gov); [pras@usgs.gov](mailto:pras@usgs.gov); [xjian@usgs.gov](mailto:xjian@usgs.gov)**

**Presenter: Andrew C. Ziegler**

The U.S. Geological Survey (USGS) in cooperation with local, State, and Federal agencies has developed a real-time water-quality monitoring system at 13 stream sites in Kansas that eliminates the waiting time inherent in chemical analyses reported by a laboratory and provides continuous estimates of concentrations and loads. Information from this system are used by water suppliers to modify treatment of water, by State and local agencies in Total Maximum Daily Load (TMDL) programs, and to alert recreational water users of potential health risks.

The USGS monitoring system is described, and its effectiveness in characterizing water quality is evaluated using data from the first 4 years of operation with examples from two sites on the Little Arkansas River. Real-time water-quality information includes hourly measurements of streamflow, specific conductance, pH, water temperature, dissolved oxygen, and turbidity. Because sensor technology currently is not available to directly measure many chemicals of interest in a stream, statistical models are developed to link constituents in laboratory-analyzed samples with the in-stream continuous-sensor measurements. Concentration (sediment, for example) estimates, traditionally have used continuous streamflow data only; however, many constituents are more accurately estimated with continuous specific conductance or turbidity measurements. As the hourly sensor measurements are transmitted from the gaging stations to the USGS computers in Lawrence, Kansas, the models are applied, and the computed estimates displayed to the Web page at <http://ks.water.usgs.gov/Kansas/rtqw/>. Currently, estimated concentrations and loads of sediment, select nutrients, chloride, atrazine, and fecal coliform bacteria, and uncertainty of the estimates are displayed.

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**Methods and Data Comparability Board**

**By: Charles A. Peters, U. S. Geological Survey, 8505 Research Way, Middleton, Wisconsin 53562, [capeters@usgs.gov](mailto:capeters@usgs.gov)**

Each year, government agencies, industry, academic researchers, and a wide variety of private organizations in the United States devote enormous time and several billion dollars to the monitoring, protection, and restoration of water resources and watersheds. Critical differences in project design, methods, data analysis, and data management have often made it difficult for monitoring information to be shared by other potential data users. In the absence of a focused effort to ensure consistent and



comparable data, and a means to determine the utility of a data set for a particular use, there is considerable redundancy and inefficiency in water assessments. The Methods and Data Comparability Board is a partnership of water quality experts from federal agencies, states, tribes, municipalities, industry, academia, and private organizations. It is chartered under the National Water Quality Monitoring Council, whose mission is to coordinate, and provide guidance on, implementation of the voluntary, integrated, nationwide monitoring strategy developed by its predecessor - the Intergovernmental Task Force on Water Quality Monitoring (ITFM, 1995a). The Board provides the framework and the forum for comparing, evaluating, and promoting monitoring approaches that can be implemented in all appropriate water quality monitoring programs.

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**USGS Guidelines for Ensuring the Quality of Information Disseminated to the Public**

**By: Walton Low, U.S. Geological Survey, 413 National Center, Reston, Virginia 20192,  
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The Treasury and General Government Appropriations Act for Fiscal Year 2001, Section 515(a) (Public Law 106-554) directed OMB to issue guidelines to Federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by Federal agencies. Office of Management and Budget directed federal agencies to develop guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by Federal agencies (Federal Register, v. 67, no. 36, February 22, 2002, p. 8452-8460).

The USGS Guidelines for Ensuring the Quality of Information Disseminated to the Public apply to all USGS-produced information in any medium, including data sets, web pages, maps, audiovisual presentations, USGS-published reports, or reports by USGS authors published by others. The Guidelines (1) adopt a basic standard of quality; (2) develop a process for reviewing the quality; (3) establish administrative mechanisms to seek & obtain timely correction of information; and (4) submit to OMB by CIO, the number, nature, & resolution of complaints each fiscal year.

The USGS compliance approach: (1) USGS information undergoes many quality assurance reviews, including peer review, to ensure the utility, objectivity, and integrity of the information; (2) USGS information has a high degree of transparency for (a) the source of data, (b) various

assumptions employed, (c) methods applied, & (d) statistical procedures employed; (3) Published USGS quality review standards: [www.usgs.gov/usgs-manual/500/500.9.html](http://www.usgs.gov/usgs-manual/500/500.9.html).

A USGS public web page ([www.usgs.gov/quality\\_of\\_info.html](http://www.usgs.gov/quality_of_info.html)) provides public entry of and tracking for complaints. A USGS internal web page ([internal.usgs.gov/info\\_qual/index.html](http://internal.usgs.gov/info_qual/index.html)) provides entry and tracking for complaints and provides guidance to USGS for complaint process requirements.

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**National Water Information System (NWIS)-QWDATA Changes**

**By: Terry L. Schertz, U.S. Geological Survey, Office of Water Quality, Denver Federal Center, MS 401, Bldg 53 Box 25046, Denver, CO 80225, [tlschertz@usgs.gov](mailto:tlschertz@usgs.gov)**

What's changed in NWIS version 4.2 and future plans.

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**Data Issues—Where Have the Data Gone? LIMS to NWIS Process**

**By: Gary Cottrell, U.S. Geological Survey, National Water Quality Laboratory, Denver Federal Center, PO Box 25046, MS 407, Denver, CO, [cottrell@usgs.gov](mailto:cottrell@usgs.gov)**

This will be a question-and-answer session that will start with a brief look at the how results and other data flow from the NWQL to the customer and on to NWIS. We will also discuss which responsibilities belong to the NWQL, which belong to the District, and which belong to NWIS.

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**Teaching Water-Quality Principles and Field Methods in Abu Dhabi****By: Franceska Wilde<sup>1</sup>, Roger Lee<sup>2</sup>, and Bob Broshears<sup>3</sup>****U.S. Geological Survey, Office of Water Quality, 412 National Center, Reston, Virginia 20192,  
[fwilde@usgs.gov](mailto:fwilde@usgs.gov)****<sup>1</sup>U.S. Geological Survey, EPA Region VI Liason, Dallas, Texas, [rwlee@usgs.gov](mailto:rwlee@usgs.gov)****<sup>2</sup>U.S. Geological Survey, Central Region, Denver Federal Center, PO Box 25046, MS 406, Denver,****<sup>3</sup>Colorado 80225, [rebroshe@usgs.gov](mailto:rebroshe@usgs.gov)**

In June, 2002, the International Division requested training on water-quality principles and field methods for personnel of the National Drilling Company of Abu Dhabi Emirate, to be held at the end of August. A 10-day hybrid course was developed that was based on the Water-Quality Principles and Ground-Water Field Methods classes taught at the National Training Center in Denver. Formulating the lecture-lab-field curriculum, facing the challenges of equipment needs and torrid climate, and navigating the cultural divide as instructors and as guests of the United Arab Emirates provided our teaching team with unique and valued experiences.

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**POSTERS (Thursday – Friday)****1. The National Field Manual: Going on Compact Disk (CD)**

**By: Franceska Wilde, U.S. Geological Survey, Office of Water Quality, 412 National Center, Reston, Virginia, [fwilde@usgs.gov](mailto:fwilde@usgs.gov)**

A CD containing the 2003 version of the *National Field Manual for the Collection of Water-Quality Data (NFM)* is in preparation and should be available by the start of the new calendar year. The CD version is not intended to replace the hard-copy or Web-based editions. The utility to users of serving the *NFM* in CD format will be evaluated before planning for future editions of NFM-CD.

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**2. Determination of gasoline oxygenates and selected degradates in ground water using heated purge and trap GC/MS and ultra-clean sampling techniques**

**By: Mark W. Sandstrom<sup>1</sup>, Donna L. Rose<sup>1</sup>, Emmanuel G. Charles<sup>2</sup>, and Arthur L. Baehr<sup>2</sup>**

<sup>1</sup> National Water Quality Laboratory, U.S. Geological Survey, P.O. Box 25046, MS 407, Denver, Colorado, 80225-0046, [sandstro@usgs.gov](mailto:sandstro@usgs.gov), [dlrose@usgs.gov](mailto:dlrose@usgs.gov)

<sup>2</sup> U.S. Geological Survey, 810 Bear Tavern Road W., Trenton, New Jersey, 08628, [echarles@usgs.gov](mailto:echarles@usgs.gov); [abaehr@usgs.gov](mailto:abaehr@usgs.gov)

A method for determination of the alkyl ethers used as gasoline oxygenates [*tert*-butyl ethyl ether (ETBE), *tert*-butyl methyl ether (MTBE), diisopropyl ether (DIPE), *tert*-pentyl methyl ether (TAME)] and some of their main degradates [acetone, methyl acetate, *tert*-butyl alcohol (tBA), and *tert*-amyl alcohol (tAA)] at low concentrations (<5 µg/L) in water samples was developed. The analytes are determined using heated extraction to improve purging of polar compounds in a standard GC/MS method for volatile compounds. Volatile analytes are extracted (purged) from the sample by bubbling helium through a 25-mL sample heated at about 65°C. Volatile compounds are trapped on a sorbent, and then thermally desorbed into a GC/MS system for identification and quantitation. The response of the alcohols tBA and tAA, which are not detected at 25°C when concentrations are below 50 µg/L, increased by a factor of 2 to 3 from 50 to 70°C. Mean recoveries from reagent-water samples analyzed over a 3-month period at concentrations from 1 to 10 µg/L for the ethers were 104 to 106 percent, with relative standard deviations (RSD) from 5 to 8 percent. The alcohols had slightly higher recoveries, 111 and 122 percent, and RSD of 10 and 11 percent, at concentrations from 10 to 100 µg/L. The method detection limits are 0.02 to 0.03 µg/L for the alkyl ethers and DIPE, and are about 0.8 µg/L for the alcohols. The method was applied to samples from an area of New Jersey where low levels of TBA in the shallow ground water were expected because of concentrations of tBA and MTBE in the unsaturated zone and atmosphere. Field quality control (QC) samples were analyzed by the method to assess its suitability for environmental samples, potential for field contamination and degradation prior to analysis.

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**3. New NWQL laboratory schedule for determination of both parent and degradate pesticides for high use pesticides (acetanilide, triazine and organophosphate pesticides)-Schedule 2003**

**By: Mark W. Sandstrom, Max E. Stroppel, Leslie K. Kanegy, and James E. Madsen, National Water Quality Laboratory, U.S. Geological Survey, P.O. Box 25046, MS 407, Denver, Colorado, 80225-0046, [sandstro@usgs.gov](mailto:sandstro@usgs.gov); [stroppel@usgs.gov](mailto:stroppel@usgs.gov); [lkanagy@usgs.gov](mailto:lkanagy@usgs.gov); [jemadsen@usgs.gov](mailto:jemadsen@usgs.gov)**

A new laboratory schedule was created that combines parent pesticides and degradates from two complementary GC/MS methods for determination of these compounds, NWQL Schedules 2001 and 2002. The schedule was created to meet the needs of the topical studies in Cycle II of the National Water Quality Assessment Program (NAWQA). These studies will focus on three major classes of pesticides, the triazine and acetanilide herbicides, and organophosphate insecticides, as well as specific urban-use pesticides. Degradates of chemicals will also be studied. The NWQL had developed two complementary GC/MS methods for determination of these compounds, NWQL Schedules 2001 and 2002\*. In order to study both the degradates and parent pesticides, it would have been necessary to analyze samples using both schedules. However, it is inefficient and expensive to request analysis of both schedules, since these include many other analytes not included in the topical studies. The new laboratory schedule, called Schedule 2003, combines parent pesticides and degradates of interest from the two complementary GC/MS methods for determination of these compounds, NWQL Schedules 2001 and 2002. The new schedule offers the same detection levels, quality control and quality assurance procedures, and analytical procedure as the primary schedules it is derived from, but provides a shorter list of analytes and cost saving for the topical studies.

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**4. Long-Term Water Quality and Streamflow Monitoring in the Lake Okeechobee Watershed: One Role of the USGS in the Comprehensive Everglades Restoration Plan**

**By: Molly S. Wood, U.S. Geological Survey, Florida Integrated Science Center, Center for Aquatic Resources Studies, 224 W Central Pkwy, Suite 1006, Altamonte Springs, Florida 32714, [mwood@usgs.gov](mailto:mwood@usgs.gov)**

Lake Okeechobee is a large, shallow lake located in south-central Florida. With a surface area of 730 square miles, it is the second largest lake within the contiguous United States and has an average depth of 9 feet. The lake is the heart of south Florida's water supply and flood control system and is the major source of water for the Everglades. During the last century, agricultural development and canal construction in the lake's watershed have resulted in excess nutrient inputs and more efficient delivery of stormwater to the lake, which in turn has resulted in more frequent blue-green algal blooms and a decline in ecosystem health. As part of a restoration plan for Lake Okeechobee and the entire south Florida ecosystem, the USGS will conduct a 10-year water quality and streamflow monitoring program at 17 sites in the Lake Okeechobee Watershed. Previous water quality monitoring in the watershed has been focused on concentrations, not loads, and has been limited in scale and frequency. Two types of water quality samples will be collected on a weekly basis: flow-weighted composite samples collected using an ISCO autosampler and samples collected manually using the Equal-Width-Increment method. The samples will be analyzed for three forms of phosphorus, three forms of nitrogen, and total suspended solids. The data will be used to compute loads, examine spatial and temporal trends in loads, plan future restoration activities in the watershed, and compare pre- and post-activity conditions.

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**5. Comparison of Passive Diffusion Bag Samplers and Submersible Pump Sampling Methods for Monitoring Volatile Organic Compounds in Ground Water at Area 6, Naval Air Station Whidbey Island, Washington**

**By: Raegan L. Huffman, U.S. Geological Survey, 1201 Pacific Ave, Suite 600, Tacoma, Washington 98402, [rhuffman@usgs.gov](mailto:rhuffman@usgs.gov)**

**[Prepared in cooperation with DEPARTMENT OF THE NAVY ENGINEERING FIELD ACTIVITY, NORTHWEST NAVAL FACILITIES ENGINEERING COMMAND]  
U.S. Geological Survey Water-Resources Investigations Report 02-4203**

Ground-water samples were collected in April 1999 at Naval Air Station Whidbey Island, Washington, with passive diffusion samplers and a submersible pump to compare concentrations of volatile organic compounds (VOCs) in water samples collected using the two sampling methods. Single diffusion samplers were installed in wells with 10-foot screened intervals, and multiple diffusion samplers were installed in wells with 20- to 40-foot screened intervals. The diffusion samplers were recovered after 20 days and the wells were then sampled using a submersible pump. VOC concentrations in the 10-foot screened wells in water samples collected with diffusion samplers closely matched concentrations in samples collected with the submersible pump. Analysis of VOC concentrations in samples collected from the 20- to 40-foot screened wells with multiple diffusion samplers indicated vertical concentration variation within the screened interval, whereas the analysis of VOC concentrations in samples collected with the submersible pump indicated mixing during pumping. The results obtained using the two sampling methods indicate that the samples collected with the diffusion samplers were comparable with and can be considerably less expensive than samples collected using a submersible pump.

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**6. National Field Quality Assurance Program (NFQA)**

**By: Sandra Womble, U.S. Geological Survey, Ocala Water Quality and Research Laboratory, 4500 SW 40<sup>th</sup> Ave, Ocala, Florida 34474, [smwomble@usgs.gov](mailto:smwomble@usgs.gov)**

Since the inception of the U.S. Geological Survey National Field Quality Assurance Program, water-quality analysts have analyzed over 85,000 proficiency samples. This includes more than 10,000 alkalinity samples, more than 15,000 pH samples, and more than 16,000 specific conductance samples, which were analyzed from 1990 through 1997, and a total of more than 43,000 proficiency samples analyzed from 1979 through 1989. The analyte values were evaluated to determine the fourth-spread, a measure of the width of the middle half of the data, and the F-pseudosigma, a robust replacement for the standard deviation, for each of the different measurement ranges. The result of the statistical evaluation showed that the vast majority of reference sample measurements made by water-quality analysts were within acceptable ranges. From 1990 to 1997, the measurement of pH had the highest level of

acceptable results, 98.4 percent, followed by specific conductance with 95.2 percent acceptable results, and alkalinity with 88.6 percent acceptable results.

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**7. Water quality monitoring of mosquito-control insecticides in the New York metropolitan area**  
**By: Stephen Terracciano, Shawn Fisher, Jack Monti, U.S. Geological Survey, 2045 Route 112, Coram, New York 11727, [saterrac@usgs.gov](mailto:saterrac@usgs.gov); [scfisher@usgs.gov](mailto:scfisher@usgs.gov); [jmonti@usgs.gov](mailto:jmonti@usgs.gov)**

West Nile Virus, a mosquito-borne disease, was first detected in the United States in 1999 in New York City. Since then, air and ground spraying of insecticides have been conducted throughout neighborhoods in the New York metropolitan area to reduce mosquito populations and thus the risk of human illness. In September 2000, the Toxics Program, in conjunction with the New York District and USGS Organic Research Laboratory, initiated a two-year project to develop and test analytical methods to detect toxicologically relevant amounts of these insecticides. Twenty ground water and surface water samples from the New York metropolitan area were analyzed by the USGS Organic Research Laboratory for methoprene, methoprene acid (its degradate), malathion, two pyrethroid compounds (phenothrin and resmethrin), and piperonyl butoxide (a chemical synergist). Piperonyl butoxide was found in water samples in areas that had not been intended for insecticide treatment, suggesting that insecticides might also have been present in these areas, but had been adsorbed, degraded, or present at concentrations below the detection limit.

In 2002, the New York District, in cooperation with Suffolk County Department of Ecology, began supplementing surface water grab samples with passive sampling to integrate transient, low-level concentrations of these compounds over time. Passive in situ samplers, semi-permeable membrane devices (SPMDs) were used to provide a measure of the bioavailability of insecticides to fresh and salt-water fish. As before, the USGS Organic Research Laboratory analyzed extract of the SPMD samples for these insecticides. Analytical results from samples collected using the semi-permeable membrane devices will be available in early 2003. Since sampling began in 2000, the USGS has collected more than 40 samples from across the New York metropolitan area.

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**8. Short-Term Diurnal Water Quality Monitoring of New Jersey Streams**  
**By: H. Hoppe, H. Heckathorn, M. Riskin, and B. Gray, U.S. Geological Survey, 810 Bear Tavern Rd, Suite 206, West Trenton, New Jersey 08628, [hhoppe@usgs.gov](mailto:hhoppe@usgs.gov); [haheck@usgs.gov](mailto:haheck@usgs.gov); [mriskin@usgs.gov](mailto:mriskin@usgs.gov); [bgray@usgs.gov](mailto:bgray@usgs.gov)**

The New Jersey Ambient Stream Monitoring Network is designed to assess the general status and trends in water quality of non-tidal and freshwater in New Jersey. Instantaneous water-quality samples are used to determine whether water quality meets the current New Jersey Water Quality Standards Criteria. This data is also used as part of the inventory to generate New Jersey State reports such as the 303d and 305b lists which identify river bodies with specific impairments. Typically, instantaneous water-quality samples from the network are collected between 8 a.m. and 2 p.m.

As part of a watershed reconnaissance study, water temperature, dissolved oxygen, percent of dissolved-oxygen saturation, pH, and specific conductance were monitored diurnally at 36 sites for 2- to 7-day periods. Samples were collected at the study sites during the summer months of 2000 through 2002 in an effort to measure diurnal variations under conditions of low flow and high temperature.

Short-term monitoring seems to provide an efficient and low-cost method for achieving water-quality coverage of a large number of streams in a short period of time. Additionally, the use of water-quality monitors for obtaining short-term diurnal records provides a more representative evaluation of physical stream characteristics than a single instantaneous value.

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**9. Water Quality Field Trucks Used by the Connecticut District**  
**By: Timothy W. Frick and Joseph W. Martin, U.S. Geological Survey, 101 Pitkin St, East Hartford, Connecticut 06108, [twfrick@usgs.gov](mailto:twfrick@usgs.gov); [jwmartin@usgs.gov](mailto:jwmartin@usgs.gov)**

Over the years, the Connecticut District has used many different styles of water-quality vehicles. Full-size vans and popup-type camper vans were at one time the mainstay of field operations when conducting water-quality field trips. During the late 1980's, Connecticut began to use utility box vans for water-quality operations. Two vans were retired in the mid 1990's, and the present Connecticut network van was built out to: (1) Accommodate parts per billion (ppb) protocols that were established in the early 1990's, and (2) Be self-contained, so that all possible field equipment, cranes, reels, samplers etc. would be available

to field personnel if needed during a field trip. In 2002, a second water-quality vehicle was built out to accommodate the NAWQA program of the Connecticut District. This poster presents photographs of the vehicles, which are designed to maintain the integrity of the sampling protocols, while providing a safe, comfortable working platform for field personnel when conducting water-quality operations.

#### 10. Water Quality Mobile Labs

**By:** Mark Johnson and Frank Moseanko, U.S. Geological Survey, 6000 J Street, Placer Hall, Sacramento, California 95819, [mvjohns@usgs.gov](mailto:mvjohns@usgs.gov); [moseanko@usgs.gov](mailto:moseanko@usgs.gov)

**Photographs by:** Cathy Munday

**Illustrator:** Yvonne Roque

Mark Johnson and Frank Moseanko will display a poster showing mobile lab vehicles used by the Sacramento, California District Office for water-quality project work. The poster features four vehicles that have been converted to facilitate water sample processing. Each vehicle is unique and has been modified for specific needs of different on-going projects. Areas of each vehicle are delineated for the different processing methods used. Photographs will illustrate areas of processing, equipment storage, waste disposal, and shipping. A binder will accompany the poster with before and after conversion photos of each of the four mobile labs.

#### 11. Design and Use of the Trinity River NAWQA Ultra-Clean Water-Quality Mobile Laboratory

**By:** John C. Rosendale<sup>1</sup> and Timothy D. Oden<sup>2</sup>

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<sup>2</sup>U.S. Geological Survey, 2320 LaBranch St, Houston, Texas 77004, [toden@usgs.gov](mailto:toden@usgs.gov)

Water-quality sampling protocols and lower detection/reporting limits have necessitated the use of dedicated clean sampling vehicles for the collection of parts per billion water-quality samples. Minimizing the components of a vehicle that could be possible sources of contamination, the Trinity River National Water Quality Assessment Program (NAWQA) study-unit designed a vehicle that reduces the exposed material that could compromise sample integrity. The truck is designed to be used for the collection of surface-water as well as ground-water samples with minimal modifications. The design and implementation of these types of vehicles has proven beneficial in the ability to collect low-level water-quality samples.

#### 12. Water-Quality Sampling Vehicles from Around the USGS

**By:** Kathy Fitzgerald, U.S. Geological Survey, Office of Water Quality, 412 National Center, Reston, Virginia 20192, [kkfitz@usgs.gov](mailto:kkfitz@usgs.gov)

Digital photographs of different types of vehicles from several U.S. Geological Survey Districts were collected and compiled as examples for others who are setting up new vehicles or modifying existing vehicles for use in water-quality project work.

#### 13. Pumping System for Monitoring Water-Quality Field Parameters at Depth-Specific Locations in Estuarine Environments, Northeast Florida

**By** Shaun M. Wicklein, U.S. Geological Survey, 224 W Central Pkwy, Suite 1006, Altamonte Springs, Florida 32714, [smwickle@usgs.gov](mailto:smwickle@usgs.gov)

The poster presented to the National Conference on Water-Quality Field Activities describes a method for measurement of water-quality field parameters using a pump system to reduce sensor fouling and improve data quality. The U.S. Geological Survey Florida Integrated Science Center developed a system to compensate for difficulties associated with remote water-quality data collection in estuaries. This method of surface water-quality data collection helps reduce sensor fouling, sensor drift, and multiple sensor variability. Development, testing, and deployment of a sampling system for remote collection of water-quality data in estuarine environments has proven effective in reducing servicing time and equipment-related variance between field-measured and remote data. This system involves use of a data logger, multi-parameter water-quality monitoring sonde, sample chamber, and pump system to monitor water-quality at multiple depths in a water column. Types of data being collected at sampling sites include temperature, conductivity, and dissolved oxygen, but could also include turbidity, and pH with the current water-quality monitoring system.

The pump system was developed to counter the following common problems associated with monitoring of field water-quality parameters in estuary environments: rapid sensor fouling, difficulty in removal and reinstallation of water-quality sondes at multiple depths (bio-fouling of mounting equipment), and increases in site servicing time due to multiple water-quality sondes at each site. Installation of the pump systems allowed each of these problems to be addressed and corrected: the water-quality sonde does not remain in the water between measurements, there is easy access to a single water-quality sonde, a single water-quality sonde with minor bio-fouling is easier to clean and service, and one set of database corrections can be applied to all depth specific measurement locations. Verification of the pump system with water-quality field parameter measurements made continuously in the water near the intake location indicate that, if care is taken in site placement and construction, water-quality measurements taken in the pump chamber will be representative of environmental conditions in the estuary.

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#### **14. Testing of the Stevens/Greenspan Aqualab Analyzer at Morgan Creek**

**By: Deborah A. Bringman, U.S. Geological Survey, 1289 McD Dr, Dover, Delaware 19901, [dabringm@usgs.gov](mailto:dabringm@usgs.gov)**

An overview of the features of the Stevens/Greenspan Aqualab Analyzer and how the Potomac Delmarva (PODL) NAWQA study unit has been testing the Stevens/Greenspan Aqualab Analyzer, in conjunction with the surface water sampling at one of our agricultural trend sites.

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#### **15. Use of the RoxAnn<sup>1</sup> streambed classification system on the Ohio River near Louisville, Kentucky**

**By: Michael D. Unthank and Hugh L. Nelson Jr., U.S. Geological Survey, 9818 Bluegrass Pkwy, Louisville, Kentucky 40299, [munthank@usgs.gov](mailto:munthank@usgs.gov); [hlnelson@usgs.gov](mailto:hlnelson@usgs.gov)**

This presentation summarizes the calibration and application of the RoxAnn streambed classification system to delineate substrate types and channel-bed profiles of the Ohio River near Louisville, Kentucky. Investigation by the Louisville Water Company to determine the potential of riverbank infiltration as a primary treatment for drinking water rely in part on knowing the different types of bed material present in the potential infiltration zones of the river and the streambed-sedimentation patterns under varying flow conditions. A remote-sensing technique was sought that would enable investigators to quickly delineate substrate types and document change and movement in the bed material over time. Investigators evaluated the RoxAnn streambed classification system's ability to delineate the various bed-material types in a section of the Ohio River adjacent to the Louisville Water Company well field near Louisville, Kentucky.

The RoxAnn system makes use of acoustic data from a conventional single-beam echo sounder to classify and map water body surficial substrates in real time. The system uses the first and second echoes from a single transmission of the echo sounder; the first echo provides a numerical index of substrate roughness and the second echo of hardness (Edsall and others, 1997). Data are displayed in real time on a Cartesian grid or "RoxAnn square" (roughness plotted against hardness), divided into substrate types, each assigned a unique color. The depths of water and channel bed geometry are also displayed in profile with the corresponding color-coded substrate type.

An initial survey of the Ohio River near Louisville, Ky., was done while operating the RoxAnn system with a 3°, 200-kHz transducer and using the default RoxAnn square. Similar substrate material types were grouped together by the default color scheme. In an effort to ground truth the RoxAnn system, a number of locations from the initial survey were resurveyed, and samples of the various bed-material types were collected by use of a BM-54 sampler. The RoxAnn square was modified based on the bed-sediment sample analyses, and the entire study area was resurveyed with the calibrated unit.

#### **Reference**

Edsall, T.A., Behrendt, T.E., Cholwek, Gary, Frey, J.W., Kennedy, G.W., and Smith, S.B., 1997, Use of Remote-Sensing Techniques to Survey the Physical Habitat of Large Rivers: U.S. Geological Survey Contribution Number 983 of the Great Lakes Science Center, 20 p.

<sup>1</sup>Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

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## **16. Real-Time Continuous Monitoring of Water Quality in Kansas Streams**

**By: Victoria G. Christensen, Andrew C. Ziegler, Patrick P. Rasmussen, and Xiaodong Jian, U.S. Geological Survey, 4821 Quail Crest Place, Lawrence, Kansas 66049, [vglenn@usgs.gov](mailto:vglenn@usgs.gov); [aziegler@usgs.gov](mailto:aziegler@usgs.gov); [pras@usgs.gov](mailto:pras@usgs.gov); [xjian@usgs.gov](mailto:xjian@usgs.gov)**

The U.S. Geological Survey (USGS) in cooperation with local, State, and Federal agencies has developed a real-time water-quality monitoring system at 13 stream sites in Kansas that eliminates the waiting time inherent in chemical analyses reported by a laboratory and provides continuous estimates of concentrations and loads. Information from this system are used by water suppliers to modify treatment of water, by State and local agencies in Total Maximum Daily Load (TMDL) programs, and to alert recreational water users of potential health risks.

The USGS monitoring system is described, and its effectiveness in characterizing water quality is evaluated using data from the first 4 years of operation with examples from two sites on the Little Arkansas River. Real-time water-quality information includes hourly measurements of streamflow, specific conductance, pH, water temperature, dissolved oxygen, and turbidity. Because sensor technology currently is not available to directly measure many chemicals of interest in a stream, statistical models are developed to link constituents in laboratory-analyzed samples with the in-stream continuous-sensor measurements. Concentration (sediment, for example) estimates, traditionally have used continuous streamflow data only; however, many constituents are more accurately estimated with continuous specific conductance or turbidity measurements. As the hourly sensor measurements are transmitted from the gaging stations to the USGS computers in Lawrence, Kansas, the models are applied, and the computed estimates displayed to the Web page at <http://ks.water.usgs.gov/Kansas/rtqw/>. Currently, estimated concentrations and loads of sediment, select nutrients, chloride, atrazine, and fecal coliform bacteria, and uncertainty of the estimates are displayed.

## **17. Current Methods of Analysis for Selected Herbicides, Insecticides, Antibiotics, Taste-and-Odor-Causing Compounds, and Their Degradation Products**

**By: E.A. Scribner, E.M. Thurman, and E.A. Lee, U.S. Geological Survey, 4821 Quail Crest Place, Lawrence, Kansas 66049, [scribner@usgs.gov](mailto:scribner@usgs.gov); [thurman@usgs.gov](mailto:thurman@usgs.gov); and L.R. Zimmerman, Center for Research, Inc., University of Kansas, Lawrence, Kansas**

In 1987, the Organic Geochemistry Research Group was established at the U.S. Geological Survey (USGS) office in Lawrence, Kansas, to investigate the fate, degradation, and transport of agricultural chemicals in surface water, ground water, and precipitation. Since that time, the goals of the research group have been expanded to include: (1) the development of analytical methods, (2) investigation of the occurrence, concentration, and movement of herbicides, insecticides, antibiotics, taste-and-odor-causing compounds, and degradation products in surface water, ground water, and precipitation throughout the United States, and (3) study of the degradation, transport, and fate of agricultural chemicals in the hydrologic system. Accomplishments of the research group include: (1) the development of approved analytical methods; (2) water-quality surveys, including streams, reservoirs, rainfall, storm runoff, and precipitation, and the results of specific research topics including the Mississippi River flood, changes in atrazine application rates, and wastewater from confined animal feeding operations; and (3) documentation of the formation and transport of deethylatrazine in the soil and vadose zone, dissipation of encapsulated herbicides, regional transport of herbicides and their degradation products in surface water, effects of pesticides on frogs, and taste-and-odor-causing compounds related to drinking water and algal production. Special projects have included studies of herbicide use on crops such as corn and cotton, mosquito insecticides applied in New York City, and pharmaceuticals in surface water of the United States. This poster summarizes the analytical methods used by USGS at their laboratory in Lawrence.

## **18. A Simple Device for Measuring Hydraulic Head Differences Between Surface Water and Shallow Ground Water**

**By: Richard Wanty, U.S. Geological Survey, MS 973, Denver Federal Center, Denver, CO 80225, [rwanty@usgs.gov](mailto:rwanty@usgs.gov)**

In many environmental investigations, stream discharges are measured and water samples are collected for chemical analyses in an effort to determine concentrations or loadings of chemical compounds of interest. These types of measurements often are used to infer sources and sinks of chemical



compounds, and to characterize the processes affecting the mobility of those compounds. An oft-overlooked source/sink term is the interaction between ground and surface water. In some stream reaches, ground water may be discharging to the stream, so contributing water with solutes to the stream water. In other reaches, ground water may be recharged by stream water percolating into the ground. Flux of water into or out of the ground is a function of the hydraulic head difference between surface and ground water, so a rapid means of evaluating the head difference will aid the hydrologist in determining the possibility that water is flowing into or out of the ground.

This poster describes a simple device for measuring the hydraulic head of shallow ground water in a stream bed. It can be used to determine whether a stream has a tendency to be gaining or losing water to or from the ground at the point of measurement. Used as part of a thorough spatial or temporal survey, such measurements can yield valuable information about the local and regional hydrology of a stream/ground-water system. In addition to providing a rapid means of evaluating hydraulic head, this device also can be used to sample shallow ground water (also known as hyporheic water) for chemical analyses, provided proper precautions are observed.

Interpretation of the results of hyporheic head measurements is heavily scale dependent. At the local scale (<10 meters or so), positive or negative vertical hydraulic gradients (VHG) are commonly observed, which are attributable to local variations in stream gradient. At the more regional scale of 100's to 1000's of meters, VHG measurements can be used in concert with geologic and geochemical measurements to interpret hydrologic processes.

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**19. Streamflow and Water-Quality Monitoring Using Automatic Samplers to Support Watershed Model Development, Potomac River Basin**

**By: Brenda Majedi and Jonathan Evans, U.S. Geological Survey, 8987 Yellowbrick Rd, Baltimore, Maryland 21237, [blfeit@usgs.gov](mailto:blfeit@usgs.gov); [jbevans@usgs.gov](mailto:jbevans@usgs.gov)**

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**20. USGS Florida Integrated Science Center, Center for Aquatic Resources Studies, Ocala, Florida (Ocala Water-Quality Research and Laboratory (OWQRL))**

**By: Constance N. Geller, U.S. Geological Survey, 4500 SW 40<sup>th</sup> Ave, Ocala, Florida 34474, [cngeller@usgs.gov](mailto:cngeller@usgs.gov)**

The USGS Florida Integrated Science Center, Center for Aquatic Resources Studies in Ocala, Florida, provides a full range of logistic, analytical, and research support for water-quality studies conducted by the USGS, as well as other federal, and state agencies and universities. Customer support, attention to detail, and our willingness to work with our customers to solve their unique problems have been the hallmarks of our business for the last 50 years. We work closely with the USGS NWQL and OWQ to provide a full line of QA/QC'd supplies and reference materials required for collection and measurement of water samples. We provide state-of-the-art analytical services using USGS and EPA approved methods. We also provide custom analyses to initiate research on the occurrence, fate, and geochemical transport of emerging contaminants.

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**21. Instrumentation Committee (ICOM)**

**By: USGS Instrumentation Committee**

The Instrumentation Committee (ICOM) was formed in 1980 to give guidance and provide oversight to the Hydrologic Instrumentation Facility (HIF). In 1995, oversight of all Water Resources Discipline field instrumentation and equipment development and support was included. The ICOM receives technical support from the Instrumentation Technical Advisory Subcommittee (ITAS). ICOM membership consists of a District Chief from each region, representatives from the Offices of Ground Water, Surface Water, and Water Quality, a representative from the National Research Program, the chair of the ITAS, a representative from the HIF, a representative from the Safety Program, and an executive secretary. Additional information can be found on the ICOM website at: <http://1stop.usgs.gov/icom/>.

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**DEMONSTRATIONS (Wednesday & Thursday)****1. Water-Quality Sampling Vehicle**

By: Susan Lane and Tammy Olivier, U.S. Geological Survey, 10500 University Center Dr, Suite 215, Tampa, Florida 33612, [slane@usgs.gov](mailto:slane@usgs.gov); [tolivier@usgs.gov](mailto:tolivier@usgs.gov)

**2. Water-Quality Sampling Vehicle**

By: John Pittman, U.S. Geological Survey, 227 N Bronough Street, Ste 3015, Tallahassee, Florida 32327, [jpittman@usgs.gov](mailto:jpittman@usgs.gov)

**3. Water-Quality Sampling Vehicle**

By: Bruce Bernard, U.S. Geological Survey, 10500 University Center Dr, Suite 215, Tampa, Florida 33612, [bbernard@usgs.gov](mailto:bbernard@usgs.gov)

**4. Water-Quality Sampling Vehicle**

By: John Rosendale<sup>1</sup>, Geneva Duhon<sup>1</sup>, and Tim Oden<sup>2</sup>

<sup>1</sup> U.S. Geological Survey, 8027 Exchange Drive, Austin, Texas 78754, [jcrosend@usgs.gov](mailto:jcrosend@usgs.gov); [gmduhon@usgs.gov](mailto:gmduhon@usgs.gov)

<sup>2</sup> U.S. Geological Survey, 320 La Branch St, Rm 1112, Houston, Texas 77004, [toden@usgs.gov](mailto:toden@usgs.gov)

**5. Demonstration of Autosampler Modified for Organics**

By: Mark Sandstrom, U.S. Geological Survey, National Water Quality Laboratory, P.O. Box 25046, MS 407, Denver, Colorado, 80225-0046, [sandstr@usgs.gov](mailto:sandstr@usgs.gov)

**6. Demonstration of Filtration of Ground-Water Samples for Pesticides Using Teflon 47-mm Diameter Filter Units**

By: Mark Sandstrom, U.S. Geological Survey, National Water Quality Laboratory, P.O. Box 25046, MS 407, Denver, Colorado, 80225-0046, [sandstr@usgs.gov](mailto:sandstr@usgs.gov)

**7. New Water-Quality Samplers, Teflon Churn Splitter**

By: Wayne O'Neal, Federal Interagency Sedimentation Project, 3909 Halls Ferry Road, Vicksburg, Mississippi 39180-6199, [woneal@usgs.gov](mailto:woneal@usgs.gov)

**8. How Samplers Work**

By: Dennis Evans, 401 Hardin Road, Little Rock, Arkansas 72211, [daevans@usgs.gov](mailto:daevans@usgs.gov)

**9. EcoLAB Demo**

By: Pete Rogerson, Office of Water Quality, Denver Federal Center, MS 401, Bldg 53 Box 25046, Denver, Colorado 80225, [rogerson@usgs.gov](mailto:rogerson@usgs.gov)

**10. Electronic Analytical Services Request Form**

By: Gary Cottrell, U.S. Geological Survey, National Water Quality Laboratory, Denver Federal Center, PO Box 25046, MS 407, Denver, CO, [cottrell@usgs.gov](mailto:cottrell@usgs.gov)

Discussion and demonstration of the electronic ASR (eASR). This tool allows field personnel to create and save templates of ASR's, receive a unique ASR number, submit ASR information electronically to the NWQL, and print bottle labels. Use of the eASR will minimize data entry errors and provide a QC check for sample submission.

**11. Handheld Computing for Water-Quality Work**

By: Frank Crenshaw, U.S. Geological Survey, 764 Horizon Drive, Room 125, Grand Junction, Colorado 81506, [fccrensh@usgs.gov](mailto:fccrensh@usgs.gov)

Demonstration of laptop and handheld versions of Personal Computer Field Forms (PCFF).

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**12. Alkalinity demo**

**By: Andy Hickey, U.S. Geological Survey, 3039 Amwiler Rd, Ste 130, Atlanta, Georgia 30360-2824, [achickey@usgs.gov](mailto:achickey@usgs.gov)**

Your chance to see the method as it's taught in the water-quality field methods training courses and to ask questions or bring up concerns about your experiences in the field.

**13. Demonstration of QWDATA 4.2**

**By: Terry Schertz<sup>1</sup>, Dorrie Gellenbeck<sup>2</sup>, and Yvonne Stoker<sup>3</sup>**

<sup>1</sup>U.S. Geological Survey, Office of Water Quality, Denver Federal Center, MS 401, Bldg 53 Box 25046, Denver, CO 80225, [tlschertz@usgs.gov](mailto:tlschertz@usgs.gov)

<sup>2</sup>U.S. Geological Survey, Office of Water Quality, Denver Federal Center, MS 421, Bldg 53 Box 25046, Denver, CO 80225, [djgell@usgs.gov](mailto:djgell@usgs.gov)

<sup>3</sup>U.S. Geological Survey, 10500 University Center Dr, Suite 215, Tampa, Florida 33612, [ystoker@usgs.gov](mailto:ystoker@usgs.gov)

Your chance to see the changes for NWIS 4.2 and to ask questions and raise concerns about how the system works, current and future functionality, why things were implemented the way they were, etc.

**14. Chemetrics Method for Dissolved Oxygen and Hydrogen Sulfide**

**By: Stan Skrobialowski<sup>1</sup> and Scott McBride<sup>2</sup>**

<sup>1</sup>U.S. Geological Survey, 3535 S Sherwood Forest Blvd, #120, Baton Rouge, Louisiana 70810, [sski@usgs.gov](mailto:sski@usgs.gov)

<sup>2</sup>U.S. Geological Survey, 10500 University Center Dr, Ste 215, Tampa, Florida 33612, [wmcbride@usgs.gov](mailto:wmcbride@usgs.gov)

**15. Ask the NAWQAnauts..**

**By: Bruce Bernard<sup>1</sup>, Dave Mueller<sup>2</sup>, Steve Moulton<sup>3</sup>, Lori Apodaca<sup>4</sup>, and Mark Sandstrom<sup>5</sup>**

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<sup>3</sup>U.S. Geological Survey, Biological Operations Manager, National Water-Quality Assessment Program, 413 National Center, Reston, Virginia 20192, [smoulto@usgs.gov](mailto:smoulto@usgs.gov)

<sup>4</sup>U.S. Geological Survey, National Water-Quality Assessment Program, 413 National Center, Reston, Virginia 20192, [lapodaca@usgs.gov](mailto:lapodaca@usgs.gov)

<sup>5</sup>U.S. Geological Survey, National Water Quality Laboratory, P.O. Box 25046, MS 407, Denver, Colorado, 80225-0046, [sandstr@usgs.gov](mailto:sandstr@usgs.gov)

Your chance to ask about NAWQA protocols, data coding, analytical methods, field schedules, etc. and express your feelings and concerns about Cycle II.

**16. Water-Quality Tool Box for National Water Information System (NWIS) Users**

**By: Robert H. Kent<sup>1</sup> and Daniel J. Hippe<sup>2</sup>**

<sup>1</sup>U.S. Geological Survey, 5735 Kearney Villa Rd, Ste O, San Diego, California 92123, [rhkent@usgs.gov](mailto:rhkent@usgs.gov)

<sup>2</sup>U.S. Geological Survey, 433 National Center, Reston, Virginia 20192, [djhippe@usgs.gov](mailto:djhippe@usgs.gov)

The recently developed "Water-Quality Tool Box" course introduces and reviews basic tools for reviewing and evaluating water quality and associated hydrologic data (additional information regarding the course can be found at: <http://vs03dmdtws.er.usgs.gov/usgs/qw/toolbox/> ). The demonstration by two course instructors will give a brief overview of the course outline and highlight some of the tools and exercises covered as part of the course. We would also encourage attendees to share your current water-quality data management challenges and approaches, such that the course can be better tailored to your needs and ideas.